

PATENT SPECIFICATION

Cite No. 132
IDS filed 12-22-2008
U.S. Appl No. 10/716,595



Convention Date (United States) : Jan. 31, 1929.

329,418

Application Date (In United Kingdom) : March 4, 1929. No. 6923/29.

Complete Accepted : May 22, 1930.

COMPLETE SPECIFICATION.

**POOR
QUALITY**

Fractional Condensation of Composite Vapours.

We, ARTHUR LOSEY, of 168—16, 77th Road, Flushing, New York, United States of America, PERRY GOTTLIEB, 225, Broadway, New York City, New York, United States of America, and LOUIS LEONARD HAUPT, of 225, Broadway, New York City, New York, United States of America, all citizens of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the fractional condensation of composite vapours.

The invention consists in a process which comprises drawing off condensate from a fractionating compartment, and subjecting it to the action of heat of a separate flow of hotter composite vapours, fractional condensation of which is effected by vaporization of the condensate while maintaining super-atmospheric vapour pressure upon the unvaporized portion of the condensate, employing the expansive energy of the resulting high pressure vapours against a movable member of an engine passing off exhaust vapours, separately drawing off the resulting condensate and separately passing off the resulting composite vapours.

The exhaust vapours are passed into direct contact with relatively lower pressure composite vapours which are thereby fractionally condensed, and the resulting combined flow of composite vapours is subjected to fractional condensation.

In accordance with the invention the expansive energy of the composite vapours passed off from a series of such fractionating compartments is employed against a movable member of an engine, the uncondensed composite vapours are passed to final condensation, the resulting condensate is drawn off and a portion thereof is subjected to the action of heat by direct contact with a flow of hotter composite vapours in one of the series of fractionating compartments thereby fractionally condensing the contacted composite vapours and evaporating a portion of the subjected condensate, the resulting condensate is drawn off and the evaporated

portion is recycled with the flow of composite vapours passing through the fractionating compartment.

Alternatively in accordance with the invention, the flow of composite vapours passing from the series of fractionating compartments to a condenser is intercepted, and the expansive energy thereof is employed to operate a movable member of an engine, the resulting composite vapours are passed off to the condenser, and a portion of the condensate produced in the heat engine is subjected to the action of heat of a separate flow of hotter composite vapours which are thereby fractionally condensed while maintaining super-atmospheric pressure upon the unvaporized portion of the condensate; the expansive energy of the resulting relatively higher pressure vapours is employed against a movable member of an engine, the exhaust vapours are passed off and the resulting condensate produced by fractional condensation of the contacted composite vapours is collected.

The condensate collected from the composite vapours passed off from the series of fractionating compartments is returned and subjected to the action of heat of a separate flow of hotter composite vapours which are thereby fractionally condensed while maintaining super-atmospheric vapour pressure upon the unvaporized portion of the returned condensate, and the expansive energy of the resulting relatively higher pressure vapours is employed against a movable member of an engine, the exhaust vapours are passed into direct contact with relatively lower pressure composite vapours which are thereby fractionally condensed, the resulting condensates are collected, and the resulting exhaust vapours are recycled with the flow of composite vapours.

In accordance with the invention a condensate is subjected to increased pressure, and the latent heat of composite vapours which are thereby fractionally condensed is supplied thereto at a relatively higher pressure than the separate flow of composite vapours which are in heat interchanging relation therewith; the heat of the vaporized condensate is converted into

[Price 1/-]

mechanical energy in a heat engine, and the resulting vapours are exhausted into direct contact with the flow of composite vapours undergoing fractional condensation.

5 The condensate produced by the interception of composite vapours proceeding to final condensation is collected and subjected to increased pressure, and latent
10 heat of composite vapours undergoing fractional condensation is supplied thereto, the condensate undergoing vaporization at a relatively higher pressure than the separate flow of composite vapours
15 which are in heat interchanging relation therewith; the heat of the vaporized condensate is expansively converted into mechanical energy in a heat engine; the resulting vapours are exhausted into direct
20 contact with composite vapours which are thereby fractionally condensed, and the resulting vapours are recycled with the flow of composite vapours to the point of interception, the lighter composite vapours
25 being passed off to final condensation.

The invention further comprises apparatus for condensing composite vapours in the manner described comprising a fractionating chamber with an inlet and outlet for the flow of composite vapours, one
30 or more compartments adapted to permit a flow of composite vapours to pass there-through, one or more heat interchanging elements arranged to effect fractional condensation of the composite vapours by
35 separate evaporation of a separate flow of higher pressure condensate, one or more engine units for converting heat energy of expansive vapours into mechanical
40 energy, one or more means for delivering condensates from one or more of the compartments into one or more of the said elements under increased pressure and passing the resulting vapours into one or
45 more of the said units, and means for delivering the resulting exhaust vapours into one or more of the said compartments.

Further, there is provided means for converting heat energy of the relatively
50 lower pressure flow of composite vapours into mechanical energy at a point in the said flow beyond the said vaporizing means, means for delivering the higher pressure vapours into one or more of the
55 engine units, means for delivering the exhaust vapours therefrom into the flow of composite vapours, means for collecting the condensate precipitated from said flow by said separate vaporization, means for
60 delivering resulting exhaust vapours and said relatively lower pressure flow of composite vapours into said means for converting heat energy, means for collecting the resulting exhaust condensate, means
65 for finally condensing the resulting com-

posite vapours, means for delivering said resulting vapours into said condenser, means for drawing off said exhaust condensate, and means for returning a portion
70 of said exhaust condensate under higher pressure into said vaporizing means.

Conveniently in accordance with the invention there are provided means for
75 fractionally condensing said flow of composite vapours by direct evaporation of contacted condensate, means for converting heat energy of the resulting combined flow of composite vapours into mechanical
80 energy, means for delivering said combined flow into said means for converting heat energy, means for collecting the resulting exhaust condensate, means for finally condensing resulting composite
85 vapours and means for delivering said resulting vapours into said condenser; means for drawing off said exhaust condensate, means for returning a portion of said exhaust condensate to said evaporating means, and means for collecting the
90 condensate resulting from fractional condensation of said flow of composite vapours by said direct evaporation.

The invention is further described by way of example with reference to the
95 accompanying drawings in which:—

Figure 1 is a diagrammatic elevation, partly in section, of apparatus in accordance with certain embodiments of this
100 invention.

Figure 2 is a broken diagrammatic elevation, partly in section, of a modified form of apparatus in accordance with certain embodiments of this invention.

Like numerals refer to similar parts
105 throughout the views.

Referring to Figure 1 of the drawings, construction of one combination of apparatus elements forming certain embodiments of my invention may be as follows;
110 adapted to be secured to and mounted upon a suitable foundation is flange 3 of shell 4 of fractionating tower 5, the lower end of which is formed by bottom plate 6 secured to said shell. Secured to and arranged within said shell are condensate
115 stripping trays 7, condensate trays 8, reflux evaporating trays 9 and 10, and condensate tray 11; said trays being provided with apertures 12, 13, 14, 15 and
120 16. Arranged within said shell are pipe coils consecutively numbered 17 to 28 inclusive. Secured to and partly closing the upper end of said shell is head 29 which is provided with outlet nozzle 30 for
125 passing off composite vapors. The fractionating tower is provided with inlet nozzle 31 to which is secured reciprocating engine 32 driving the armature of electric generator 33 and having supply 130

**POOR
QUALITY**

pipe 34 secured thereto, through which the composite vapors are introduced into fractionating compartments numbered 35 to 45 inclusive. Secured to the outlet nozzle 30 is elbow nozzle 46 provided with valve 47 for controlling the flow of vapors passing through said nozzle into turbine 48 in which is the rotatably mounted rotor for driving electric generator 49.

Connection 50 is provided for delivering the expanded vapors into condensate collecting chamber 51 of condensate collector 52 which is provided with condensate pipe 53 in which is interposed pump 54 for delivering a portion of said condensate into the reflux evaporating tray 10 and for delivering a separate portion of said condensate through pipe 55 into the reflux evaporating tray 9. Condensate stripping pipes 56 and 57 are provided for drawing off condensate from the reflux evaporating trays. Condensate stripping pipes 58, 59, 60 and 61 are provided for drawing off respective condensates, and pipes 62, 63 and 64 are provided with interposed pumps 65, 66 and 67 for delivering condensate at increased pressure into respective pipe coils; the lower coils of the respective coil groups are provided with vapor pipes 68, 69 and 70. Interposed in vapor pipe 68 is valve 71 for controlling the flow of high pressure vapors through nozzle 72 of turbine 73 in which a rotatably mounted rotor is arranged to rotate the armature of electric generator 74. Connection 75 is provided for delivering the exhaust into fractionating compartment 42. Interposed in vapor pipe 69 is valve 76 for controlling the delivery of high pressure vapors to expansion nozzle 77 of turbine 78 in which a rotor is arranged to rotate the armature of electric generator 79. Connection 80 is provided for delivering the expanded vapors into fractionating compartment 40. Interposed in vapor pipe 70 is valve 81 for controlling the delivery of high pressure vapors into reciprocating engine 82 arranged to rotate the armature of the electric generator 83. Connection 84 is provided for delivering the expanded vapors into the fractionating compartment 38. Overflow pipe 85 is provided and extends through the bottom plate for drawing off the bottom condensate. The condensate collector 52 is provided with overflow pipe 86 in which is interposed trap 87 for controlling flow into run-down tank 88. The pipe connection 89 provides for passing off vapors for final condensation in condenser 90. The condenser is provided with condensate pipe 91 in which is interposed pump 92 for drawing off and delivering the condensate and vapor against the pressure of the

atmosphere.

Operation of a process and apparatus in accordance with certain embodiments of my invention is as follows; assuming that a flow of composite vapors at a pressure about equal to that of the atmosphere is to be admitted into the fractionating tower at a pressure of 10 pounds per square inch absolute and passed off from the tower at 9 pounds per square inch absolute pressure and finally condensed in the condenser at 3 pounds per square inch absolute pressure, then referring to Fig. 1 of the drawing; the composite vapors flowing through supply pipe 34, by a limited expansion actuate the piston of engine 32 driving the armature of generator 33, effecting precipitation of a definite condensate, the exhaust vapors and resulting condensate are discharged through inlet nozzle 31 into fractionating compartment 35, and the condensate is collected on bottom plate 6 together with such unvaporized liquid as may have been introduced with the vapors. The flow of released composite vapors passes through a series of apertures numbered 12 to 16 inclusive, and is successively fractionally condensed while passing through the succeeding fractionating compartments 36 to 45 inclusive; the resulting condensates are collected upon a series of condensate trays and are drawn off from condensate stripping trays 7. The bottom condensate is drawn off through overflow pipe 85. The released vapors pass off through outlet nozzle 30 and enter the elbow nozzle 46 controlled by valve 47, thence with a limited expansion through the expansion portion of said nozzle, performing a limited amount of work upon the rotor of turbine 48 driving electric generator 49; the resulting limited heat loss causes fractional condensation of composite vapors by effecting condensation of vapor compounds forming a heavier condensate than that of the product of final condensation, which with the vapors pass through connection 50 into condensate collecting chamber 51 of the condensate collector 52. The resulting composite vapors pass through pipe connection 89 into condenser 90 and are condensed. A portion of the heavier condensate collected in the condensate collecting chamber is drawn off through condensate pipe 53, a portion being sent by pump 54 through pipe 53 into reflux evaporating tray 10 and a portion through pipe 55 into reflux evaporating tray 9. The surplus portion of said heavier condensate collected in the condensate collector 52 overflows through pipe 86 controlled by trap 87 into run-down tank 88. Heat absorbed by evaporation of the returned condensate from the

reflux evaporating trays 9 and 10 causes condensation of vapor compounds forming a still heavier condensate which is collected upon each tray and overflow through condensate stripping pipes 56 and 57. The condensates collected upon condensate stripping trays 7 overflow through the respective condensate stripping pipes 58; 59, 60 and 61. A portion of condensate is removed from condensate stripping pipe 58 through pipe 62 and is sent by pump 65 under increased pressure into pipe coils 17 and 18 where vaporization of a portion of the condensate is effected under higher vapor pressure as the separate low pressure flow of hotter composite vapors in fractionating compartment 41 is fractionally condensed thereby; the higher pressure condensate and its vapors pass into pipe coils 19 and 20 where vaporization of the condensate is completed by heat supplied by still hotter vapors being fractionally condensed in fractionating compartment 40; the resulting higher pressure vapors pass through vapor pipe 68 controlled by valve 71 into expansion nozzle 72. Expansion of vapors causes rotation of the rotor of turbine 73 driving the electric generator 74, and causing precipitation of condensate which is then exhausted with the resulting vapors through connection 75 into fractionating compartment 42, the vapors are then recycled with the flow of composite vapors passing into fractionating compartment 43. Heat absorbed by evaporation of the exhaust condensate causes condensation of vapor compounds which are collected upon condensate stripping tray 7 of fractionating compartment 42. The resulting condensate is drawn off through condensate stripping pipe 58, a portion flows into pipe 62 and is recycled by the pump 65. The condensate formed in the fractionating compartment 40 passes into the condensate stripping pipe 59; flows into pipe 63 and is sent by pump 66 at increased pressure through pipe 63 into pipe coils 21 and 22 where vaporization of a portion of the condensate is effected under higher vapor pressure as the separate still hotter composite vapors in fractionating compartment 39 are fractionally condensed thereby; the higher pressure condensate and its vapors pass into pipe coils 23 and 24 where vaporization of the condensate is completed by heat supplied by still hotter vapors being fractionally condensed in fractionating compartment 38; the resulting higher pressure vapors pass through vapor pipe 69 controlled by valve 76 into expansion nozzle 77. Expansion of vapors causes rotation of the rotor in turbine 78 driving the armature of electric generator 79; thereby causing precipitation of condensate which is then exhausted with the resulting vapors through connection 80 into fractionating compartment 40; the vapors are then recycled with the flow of composite vapors passing into fractionating compartment 41. Heat absorbed by evaporation of exhaust condensate causes condensation of contacted vapor compounds which are collected upon condensate stripping tray 7 of fractionating compartment 40. The resulting condensate is drawn off through condensate stripping pipe 59, a portion flows into pipe 63 and is recycled by pump 66. A portion of the next heavier condensate drawn off by the condensate stripping pipe 60, flows into pipe 64 and is sent by pump 67 under increased pressure through pipe 64 into pipe coil 25 where vaporization of a portion of the condensate is effected under higher vapor pressure as the separate still hotter composite vapors in fractionating compartment 37 are fractionally condensed thereby; the higher pressure condensate and its vapors pass into pipe coil 26 where vaporization of the condensate is more nearly completed by heat supplied by still hotter vapors being fractionally condensed in fractionating compartment 36, thence into pipe coils 27 and 28 where vaporization of the condensate is completed by heat supplied by still hotter composite vapors being fractionally condensed in fractionating compartment 35; the resulting higher pressure vapors pass through vapor pipe 70 controlled by valve 81 into reciprocating engine 82. Expansion of vapors against the piston causes rotation of the crank shaft driving the armature of electric generator 83, thereby causing precipitation of condensate which is then exhausted with the resulting vapors through connection 84 into fractionating compartment 38; the vapors are then recycled with the flow of composite vapors passing into fractionating compartment 39. Heat absorbed by vaporization of exhaust condensate causes condensation of contacted vapor compounds which are collected upon condensate stripping tray 7 of fractionating compartment 38. The resulting condensate is drawn off by condensate stripping pipe 60, a portion flows into pipe 64 and passes into pump 67 and is recycled as just described. The condensate collected upon condensate stripping tray 7 of the fractionating compartment 36 is drawn off through condensate stripping pipe 61. The bottom condensate together with such unvaporized liquid as may have been introduced with the composite vapors is drawn off through overflow pipe 85. The surplus condensate collected in the condensate collector 52 is drawn

off through overflow pipe 86, controlled by trap 87 and is collected in the run-down tank 88. The final condensate of the condenser 90 passes into condensate pipe 91 and is drawn off by action of pump 92 and delivered against the pressure of the atmosphere.

Referring to Fig. 2 of the drawing, construction of a modified form of apparatus elements forming certain embodiments of my invention may be as follows; arranged within the shell 4 are pipe coils consecutively numbered 93 to 103 inclusive. The lower coils of the respective coil groups are provided with vapor pipes 104 and 105 having interposed valves 120 and 121 for supplying high pressure vapors to expansion nozzles 122 and 123 for turbines 106 and 107 having pipe connections 108 and 109 respectively for delivering the expanded vapors into respective fractionating compartments 111 and 110. The condensate stripping pipe 58 is provided with pipe 112 in which is interposed pump 65. The condensate tray 8 of fractionating compartment 111 is provided with a condensate stripping pipe 113. Secured to the outlet nozzle 30 is nozzle pipe 114 in which is interposed valve 115 for controlling the flow of vapors passing through expansion nozzle 116 into turbine 117 in which is arranged a rotor for driving the armature of electric generator 49. Connection 118 is provided for delivering the expanded vapors into the condensate collecting chamber 51 of condensate collector 52 said condensate collector is provided with condensate pipe 119 in which is interposed pump 54 for delivering a portion of said condensate into pipe coil 93 under increased pressure.

Referring to Fig. 2 of the drawing, operation of a modified form of process and apparatus in accordance with certain embodiments of my invention is as follows: the flow of composite vapors passes from fractionating compartment 39 through a series of apertures alternately numbered 12 and 13 and is successively fractionally condensed while passing through fractionating compartments 40, 41, 110 and 111; the resulting condensates are collected upon a series of condensate trays 7 and 8. The released vapors pass off through outlet nozzle 30 and enter the nozzle pipe 114 controlled by valve 115, thence with a limited expansion through expansion nozzle 116, performing a limited amount of work upon the rotor of turbine 117 driving the armature of electric generator 49; the resulting limited heat loss causes fractional condensation of composite vapors by effecting condensation of vapor compounds forming a heavier condensate than that of the product of final

condensation, which with the vapors pass through connection 118 into condensate collecting chamber 51 of the condensate collector 52. A portion of the heavier condensate collected in the condensate collecting chamber is drawn off through condensate pipe 119 and is sent by pump 54 at increased pressure into pipe coil 93 where vaporization of a portion of the separate returned condensate is effected under higher vapor pressure than the separate low pressure flow of hotter composite vapors in fractionating compartment 111 is fractionally condensed thereby, the higher pressure condensate and its vapors pass into pipe coils 94, 95, 96 and 97 where vaporization of the condensate is made more complete by heat supplied by still hotter vapors being fractionally condensed in fractionating compartment 110, the higher pressure flow then passes into pipe coils 98 and 99 where vaporization of the returned condensate is completed by heat supplied by still hotter vapors being fractionally condensed in fractionating compartment 41; the resulting higher pressure vapors pass through vapor pipe 104 controlled by valve 120 into expansion nozzle 122. Expansion of vapors causes rotation of the rotor of turbine 106 driving the armature of electric generator 74, thereby causing precipitation of condensate which is then exhausted with the resulting vapors through connection 108 into fractionating compartment 111; the vapors are then recycled with the flow of composite vapors passing through the outlet nozzle 30. Heat absorbed by vaporization of the exhaust condensate causes condensation of vapor compounds which are collected upon condensate tray 8 of the fractionating compartment 111. The condensate collected upon the condensate stripping tray 7 of compartment 110 is drawn off by condensate stripping pipe 58, a portion of the condensate flows into pipe 112 and is sent by pump 65 under increased pressure into pipe coils 100 and 101 where vaporization of a portion of the condensate is effected under higher vapor pressure as the separate still hotter composite vapors in fractionating compartment 40 is fractionally condensed thereby, the higher pressure condensate and its vapors pass into pipe coils 102 and 103 where vaporization of the condensate is completed by heat supplied by still hotter composite vapors being fractionally condensed in compartment 39; the resulting higher pressure vapors pass through vapor pipe 105 controlled by valve 121 into expansion nozzle 123. Expansion of vapors causes rotation of the rotor in turbine 107 driving the armature of electric generator

79; thereby causing precipitation of condensate which is then exhausted with the resulting vapors through connection 109 into fractionating compartment 110; the vapors are then recycled with the flow of composite vapors passing into fractionating compartment 111. Heat absorbed by evaporation of exhaust condensate causes condensation of vapor compounds which are collected upon condensate stripping tray 7 of the fractionating compartment 110. The resulting condensate is drawn off through condensate stripping pipe 58, a portion flows into pipe 112 and passes into pump 65 which recycles the condensate as just described. The upper condensate collected upon condensate tray 8 of the fractionating compartment 111 is drawn off through condensate stripping pipe 113.

I do not desire to limit my invention to the illustration shown in the drawing, nor to the description referring to Fig. 1 and Fig. 2.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The process of fractionally condensing composite vapours, which comprises drawing off condensate from a fractionating compartment, and subjecting it to the action of heat of a separate flow of hotter composite vapours, fractional condensation of which is effected by vaporization of the condensate while maintaining super-atmospheric vapour pressure upon the unvaporized portion of the condensate, employing the expansive energy of the resulting high pressure vapours against a movable member of an engine passing off exhaust vapours, separately drawing off the resulting condensate and separately passing off the resulting composite vapours.

2. A process as claimed in Claim 1, in which the exhaust vapours are passed into direct contact with relatively lower pressure composite vapours which are thereby fractionally condensed, and the resulting combined flow of composite vapours is subjected to fractional condensation.

3. A process as claimed in Claim 2, in which the expansive energy of the composite vapours passed off from a series of such fractionating compartments is employed against a movable member of an engine, the uncondensed composite vapours are passed to final condensation, the resulting condensate is drawn off and a portion thereof is subjected to the action of heat by direct contact with a flow of hotter composite vapours in one of the series of fractionating compartments

thereby fractionally condensing the contacted composite vapours and evaporating a portion of the subjected condensate, the resulting condensate is drawn off and the evaporated portion is recycled with the flow of composite vapours passing through the fractionating compartment.

4. A process as claimed in Claim 2, in which the flow of composite vapours passing from the series of fractionating compartments to a condenser is intercepted and the expansive energy thereof is employed to operate a movable member of an engine, the resulting composite vapours are passed off to the condenser, and a portion of the condensate produced in the heat engine is subjected to the action of heat of a separate flow of hotter composite vapours which are thereby fractionally condensed while maintaining super-atmospheric vapour pressure upon the unvaporized portion of the condensate; the expansive energy of the resulting relatively higher pressure vapours is employed against a movable member of an engine, the exhaust vapours are passed off and the resulting condensate produced by fractional condensation of the contacted composite vapours is collected.

5. A process as claimed in Claims 1 and 2, in which the condensate collected from the composite vapours passed off from a series of fractionating compartments is returned and subjected to the action of heat of a separate flow of hotter composite vapours which are thereby fractionally condensed while maintaining super-atmospheric vapour pressure upon the unvaporized portion of the returned condensate; the expansive energy of the resulting relatively higher pressure vapours is employed against a movable member of an engine, the exhaust vapours are passed into direct contact with relatively lower pressure composite vapours which are thereby fractionally condensed, the resulting condensates are collected, and the resulting exhaust vapours are recycled with the flow of composite vapours.

6. A process as claimed in Claims 1 and 2, in which a condensate is subjected to increased pressure and the latent heat of composite vapours which are thereby fractionally condensed is supplied thereto at a relatively higher pressure than the separate flow of composite vapours which are in heat interchanging relation therewith; the heat of the vaporized condensate is converted into mechanical energy in a heat engine, and the resulting vapours are exhausted into direct contact with the flow of composite vapours undergoing fractional condensation.

7. A process as claimed in Claims 1 and

2, in which the flow of fractionally condensed composite vapours passing to final condensation is intercepted and subjected to increased pressure, and the latent heat of composite vapours undergoing fractional condensation is supplied thereto at a relatively higher pressure than the separate flow of composite vapours which are in heat interchanging relation therewith; the heat of the vaporized condensate is expansively converted into mechanical energy in a heat engine, the resulting vapours are exhausted into direct contact with composite vapours which are thereby fractionally condensed; and the resulting vapours are recycled with the flow of composite vapours to the point of interception, the lighter composite vapours being passed off for final condensation.

8. A process as claimed in Claims 1 and 2, in which the flow of composite vapours is fractionally condensed by a series of evaporation effects; the expansive energy of resulting composite vapours is employed in the performance of work in a heat engine thereby precipitating a further condensate; the lighter composite vapours are passed off; a portion of the further condensate is employed to produce one of the evaporation effects; the vaporized returned condensate is recycled with resulting composite vapours employed in the conversion of heat into mechanical energy, and the lighter composite vapours are passed off for final condensation.

9. The process of fractionally condensing composite vapours substantially as hereinbefore described.

10. Apparatus for condensing composite vapours comprising a fractionating chamber with an inlet and outlet for the flow of composite vapours, one or more compartments adapted to permit a flow of composite vapours to pass therethrough, one or more heat interchanging elements arranged to effect fractional condensation of the composite vapours by separate vaporization of a separate flow of higher pressure condensate, one or more engine units for converting heat energy of expansive vapours into mechanical energy, one or more means for delivering condensates from one or more of the compartments into one or more of the said elements under increased pressure, and passing the resulting vapours into one or more of the said

engine units, and means for delivering the resulting exhaust vapours into one or more of the said compartments.

11. Apparatus as claimed in Claim 10 comprising means for converting heat energy of the relatively lower pressure flow of composite vapours into mechanical energy at a point in the said flow beyond the said vaporizing means, means for delivering the higher pressure vapours into one or more of the engine units, means for delivering the exhaust vapours therefrom into the flow of composite vapours, means for collecting the condensate precipitated from said flow by said separate vaporization, means for delivering resulting exhaust vapours and said relatively lower pressure flow of composite vapours into said additional means for converting heat energy, means for collecting the resulting exhaust condensate, means for finally condensing the resulting composite vapours, means for delivering said resulting vapours into said condenser, means for drawing off said exhaust condensate, and means for returning a portion of said exhaust condensate under higher pressure into said vaporizing means.

12. Apparatus as claimed in Claim 10 comprising means for fractionally condensing said flow of composite vapours by direct evaporation of contacted condensate, means for converting heat energy of the resulting combined flow of composite vapours into mechanical energy, means for delivering said combined flow into said means for converting heat energy, means for collecting the resulting exhaust condensate, means for finally condensing resulting composite vapours and means for delivering said resulting vapours into said condenser, means for drawing off said exhaust condensate, means for returning a portion of said exhaust condensate to said evaporating means, and means for collecting the condensate resulting from fractional condensation of said flow of composite vapours by said direct evaporation.

13. Apparatus for condensing composite vapours substantially as hereinbefore described and as illustrated in and by the accompanying drawing.

Dated this 4th day of March, 1929.

MARKS & CLERK.

[This Drawing is a reproduction of the Original on a reduced scale.]

